



LLŶR

LLŶR FLOATING OFFSHORE WIND PROJECT

Llŷr Floating Offshore Wind Farm

Environmental Statement

**Volume 6: Appendix 24C – Marine Archaeology and Cultural
Heritage Technical Report**

August 2024





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Summary

Coracle Archaeology was commissioned by Llŷr Floating Wind Ltd to undertake marine archaeological assessments for the Llŷr 1 Floating Offshore Wind Project. This included a marine archaeological desk-based assessment and an archaeological review of marine geophysical and landfall survey data, the results of which are collated here.

The Llŷr 1 Floating Offshore Wind Project consists of a test and demonstration offshore wind farm development, located in Welsh waters in the Celtic Sea. The Array Area will consist of up to ten floating wind turbine generators with an operational life of 30 years. The proposed Array Area is located c. 35km from the Welsh coastline, in water depths of c. 60-70m. The Offshore Development Area, encompassing both the Array Area and the offshore export cable corridor, will come ashore at Freshwater West, on the Pembrokeshire coast.

The desk-based assessment of marine and coastal cultural heritage assessed the Llŷr 1 Offshore Development Area, from mean high water springs at Freshwater West, as well as a wider study area extending around the Offshore Development Area. This report summarises the results solely from within the Offshore Development Area. Assessment of marine geophysical survey data included the analysis of multibeam echosounder, sidescan sonar, magnetometer and sub-bottom profiler data. It should be noted that these surveys were conducted within an earlier iteration of the proposed offshore export cable corridor, the nearshore parts of which are now redundant. Following revisions in April 2024, additional geophysical surveys will be required which will undergo archaeological assessment. It is anticipated that, in agreement with the Royal Commission on the Ancient and Historical Monuments of Wales, this will be done post-consent. Non-intrusive surveys at the proposed landfall location at Freshwater West comprised geophysical, walkover and hand-held metal detector surveys.

The desk-based assessment recorded 41 cultural heritage assets within the Offshore Development Area. These include 25 wrecks, two aircraft, two obstructions, one maritime named location, four findspots, three sites, one monument, two features and one geophysical anomaly identified by previous surveys in the area. None of the wrecks are designated or protected, and the monument is not scheduled.

Analysis of the marine geophysical survey data identified 29 geophysical anomalies with archaeological potential. Of these, five are considered of high archaeological potential, including four positively identified wreck sites, and 12 of medium potential. Only four geophysical anomalies with archaeological potential are located in the revised iteration of the Offshore Development Area, including one considered to be of high, and two of medium, archaeological potential. Archaeological exclusion zones have been proposed around all anomalies of high and medium archaeological potential. No features of clear archaeological potential were identified in the assessment of landfall geophysical and metal-detector survey data, though it is possible that deposits indicative of the submerged forest known to exist at Freshwater West are visible at depth. One linear anomaly was visible in the landfall survey data; this is believed to be a relict Ministry of Defence listening cable. Adopting the precautionary principle, an additional exclusion zone has been proposed around a known wreck site located on the beach at Freshwater West.

Assessment of the sub-bottom profiler data revealed thick Quaternary deposits distributed across the Array Area and southern sectors of the offshore export cable corridor. These consist primarily of late Devensian glacial deposits. Closer to shore, mobile sediments sit above the underlying geology. Many of these features are likely to consist of till clays, sands and gravels, with boulders also observed within some of the fills in the Array Area.



A number of channel features are also visible in the Offshore Development Area, though these lack any associated floodplain features and are likely to be late Pleistocene in origin. No deposits or features attributable to temperate environments – conducive to occupation – were observed in the sub-bottom data.



Acronyms and abbreviations

Acronym or Abbreviation	Definition	Acronym or Abbreviation	Definition
ADS	Archaeology Data Service	MIS	Marine Isotope Stage
AEZ	Archaeological exclusion zone	MoD	Ministry of Defence
BGS	British Geological Survey	mS/m	milliSiemens / metre
BIIS	British-Irish ice sheet	MW	Megawatt
BP	Before present	nm	Nautical miles
CA	Coracle Archaeology	NMRW	National Monument Record of Wales
Cifa	Chartered Institute for Archaeologists	NMW	National Museum of Wales
COARS	Coastal and offshore archaeological research services	NPRN	National primary reference number
DAT	Dyfed Archaeological Trust	OSGB	Ordnance Survey Great Britain
DBA	Desk-based assessment	OSL	Optically-stimulated luminescence
EEZ	Exclusive economic zone	PaMELA	Palaeolithic and Mesolithic artefact database
EM	Electro-magnetic	PRN	Primary reference number
EMODnet	European Marine Observation and Data Network	RCAHMW	Royal Commission on the Ancient and Historical Monuments of Wales
EPSG	European Petroleum Survey Group	ROV	Remotely-operated vehicle
Ft	Feet	RSL	Relative sea-level
GIA	Global isostatic adjustment	SBP	Sub-bottom profiler
GIS	Geographic Information System	SEA	Strategic Environmental Assessment
GPS	Global Positioning System	SLIP	Sea-level index point
grt	Gross registered tonnage	SSS	Sidescan sonar
HER	Historic Environment Record	SSSI	Site of special scientific interest
Hz	Hertz	UHRS	Ultra high resolution seismic
ka	Kilo annum	UKHO	United Kingdom Hydrographic Office
LAT	Lowest astronomical tide	USBL	Ultra short baseline
LGM	Last glacial maximum	UTM	Universal Transverse Mercator
MBES	Multibeam echosounder	VORF	Vertical offshore reference frames
MCA	Marine Coastguard Agency	WGS	World Geodetic System
MEDIN	Marine Environment Data Information Network	WSA	Wider Study Area
MHWM	Mean high water mark	WTG	Wind turbine generator
MHWS	Mean high water springs		



Glossary of project terms

Term	Definition
The Applicant	The developer of the Project, Llŷr Floating Wind Limited
Array	All wind turbine generators, inter array cables, mooring lines, floating sub-structures and supporting subsea infrastructure within the Array Area, as defined, when considered collectively, excluding the offshore export cable(s).
Array Area	The area within which the wind turbine generators, inter array cables, mooring lines, floating sub-structures and supporting subsea infrastructure will be located
Floventis Energy	A joint venture company between Cierco Ltd and SBM Offshore Ltd of which Llŷr Floating Wind Limited is a wholly owned subsidiary.
Landfall	The location where the offshore export cable(s) from the Array Area, as defined, are brought onshore and connected to the onshore export cables (as defined) via the transition joint bays (TJB).
Llŷr 1	The proposed Project, for which the Applicant is applying for Section 36 and Marine Licence consents. Including all offshore and onshore infrastructure and activities, and all project phases.
Marine Licence	A licence required under the Marine and Coastal Access Act 2009 for marine works which is administered by Natural Resources Wales (NRW) Marine Licensing Team (MLT) on behalf of the Welsh Ministers.
Offshore Development Area	The footprint of the offshore infrastructure and associated temporary works, comprised of the Array Area and the Offshore Export Cable Corridor, as defined, that forms the offshore boundary for the S36 Consent and Marine Licence application
Offshore Export Cable	The cable(s) that transmit electricity produced by the WTGs to landfall.
Offshore Export Cable Corridor (OfECC)	The area within which the offshore export cable circuit(s) will be located, from the Array Area to the Landfall.
Onshore Development Area	The footprint of the onshore infrastructure and associated temporary works, comprised of the Onshore Export Cable Corridor and the Onshore Substation, as defined, and including new access routes and visibility splays, that forms the onshore boundary for the planning application.
Onshore Export Cable(s)	The cable(s) that transmit electricity from the landfall to the onshore substation
Onshore Export Cable Corridor (OnECC)	The area within which the onshore export cable circuit(s) will be located.
Proposed Project	All aspects of the Llŷr 1 development (i.e. the onshore and offshore components of Llŷr 1).
Onshore Substation	Located within the Onshore Development Area, converts high voltage generated electricity into low voltage electricity that can be used for the grid and domestic consumption.



Term	Definition
Section 36 consent	Consent to construct and operate an offshore generating station, under Section 36 (S.36) of the Electricity Act 1989. This includes deemed planning permission for onshore works.



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24-C MARINE ARCHAEOLOGY AND CULTURAL HERITAGE TECHNICAL REPORT

24.1 Outline

1. Coracle Archaeology was commissioned by Llŷr Floating Wind Ltd (hereafter referred to as 'the Applicant') to undertake marine archaeological assessments for the Llŷr 1 Floating Offshore Wind Project (henceforth 'the proposed Project'), including an archaeological desk-based assessment (DBA), non-intrusive geophysical and walkover surveys at the landfall location, and an archaeological assessment of marine geophysical survey data. The results of those assessments are collated in this technical report.

24.1.1. *The proposed Project*

2. The proposed Project consists of a test and demonstration offshore wind farm development, located in Welsh waters in the north-east of the Celtic Sea (**Volume 5: Figure 24C-1**). The Llŷr 1 Array Area will be located c. 35 km from the Welsh coastline and c. 54 km from Lundy Island, in water depths averaging c. 60-70m below lowest astronomical tide (LAT). The proposed offshore export cable corridor (OfECC) will make landfall at Freshwater West, Pembrokeshire. The Array Area will consist of up to 10 floating wind turbine generators (WTGs), with an operational life of 30 years.

24.1.2. *Archaeological Assessments*

Desk-Based Assessment

3. The marine archaeological DBA (Coracle Archaeology 2024a) gathered and collated data for all recorded sites and features of cultural heritage interest in proximity to the Offshore Development Area. This includes the Llŷr 1 Array Area and the OfECC, up to mean high water springs (MHWS) at Freshwater West. It also assessed a wider study area (WSA) which extended a further 1 km beyond the Array Area and 500m either side of the proposed OfECC (**Volume 5: Figure 24C-2**), thus facilitating a broader understanding of the archaeological potential of the region.

Marine Geophysical Survey

4. Marine geophysical survey data were collected by N-SEA between September and December 2022 (N-SEA 2023). This included the collection of multibeam echosounder (MBES), sidescan sonar (SSS), marine magnetometer and sub-bottom profiler (SBP) data. Archaeological assessment was conducted subsequently by our colleagues at Coastal and Offshore Archaeological Research Services (COARS), University of Southampton on behalf of Coracle Archaeology. The results of the assessment were then compared with the marine archaeological DBA (Coracle Archaeology 2024b).
5. Marine geophysical survey data were collected for an earlier iteration of the Offshore Development Area. Consequently, there are currently significant gaps in the geophysical survey coverage for nearshore sectors of the OfECC as it approaches Freshwater West (**Volume 5: Figure 24C-3**). Further surveys are required to assess the revised OfECC; it is anticipated that, in agreement with the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW), these will be undertaken post-submission. These will require archaeological assessment, following the methodologies outlined in Coracle Archaeology (2024b).

Landfall Surveys

6. The landfall surveys assessed two potential offshore export cable locations, one situated in the centre of the beach at Freshwater West (southern option) and the other located to the



north, in the area known as Gravel Bay (northern option). The latter is now the preferred option. Landfall surveys included the collection of geophysical (electro-magnetic), metal detector and walkover survey datasets. Surveys were conducted within a 300m survey grid, extending 150m either side of the potential offshore export cable centreline, from mean high water into the intertidal zone.

7. All surveys were undertaken by Coracle Archaeology personnel in May 2023. Terrestrial geophysical survey data were processed and assessed by Headland Archaeology and TigerGeo. The results of the surveys were compared with the results of the DBA to provide a fuller understanding of the archaeological potential of the proposed landfall locations and to assess the potential impact of the proposed Project on identified heritage resources (Coracle Archaeology 2024a).

24.2 Aims and Objectives

8. The aim of this technical report is to present the current understanding of the marine archaeology and cultural heritage that exists within and in proximity to the proposed Project.
9. The objectives of this report are:
 - To synthesize all the project-specific archaeological assessments that have been completed to date; and
 - To include information relevant only to the current proposed project. All superfluous information has been removed, wherever possible, with reference made to the original report where the additional information can be found (e.g. Coracle archaeology 2024a and b).

24.3 Legislative Frameworks and Guidance

10. As the proposed project is located in Welsh waters, the assessments took account of the following national and international legislative procedures and guidelines:
 - Wales
 - *Historic Environment (Wales) Act 2016*. This Act forms part of a wider suite of legislation, policy and guidance notes that ensures the protection and sustainable management of the Welsh Historic Environment. It should be read in conjunction with Cadw's Technical Advice Note 24: the historic environment (Welsh Government 2017), which provides guidance on development plans, designated assets and archaeological remains;
 - *The Planning (Listed Buildings and Conservation Areas; Wales) Regulations 2012*. This Act provides for the development and implementation of both a National Development Framework for Wales and Strategic Development Plans. It should be noted that planning law falls within the remit of local authorities, which extends to mean low water springs (MLWS);
 - *Planning Policy Wales (2021)*. Planning Policy Wales (11th edition) was published in February 2021 and contains the principal guidance for the management and safeguarding of the historic environment within the planning process. It is supported by a series of technical advice notes, which seek to clarify and outline relevant policy for different sectors. This includes Technical Advice Note 24: the historic environment (Welsh Government 2017);
 - *Welsh National Marine Plan 2019 (especially Objective 7; policies SOC_05-07)*. The Welsh National Marine Plan (WNMP) was developed in accordance with the Marine and Coastal Access Act (2009) and the UK Marine Policy Statement. From its publication in 2019, it is designed to last for 20 years. Objective 7 of the WNMP states



that valuable landscapes, seascapes and historic assets should be protected and promoted, while encouraging the enjoyment and stewardship of Welsh coasts and seas. This is supported by policies SOC_05-07, which state that proposed developments must demonstrate how they will avoid, minimise or mitigate impacts to cultural heritage assets and seascapes, while encouraging opportunities to enhance those assets; and

- *Future Wales: The National Plan 2040*. Future Wales: the National Plan 2040 was published in 2021. It is a 20-year national development plan for Wales, designed to address key national priorities through the planning system. It is informed by the WNMP and complements Planning Policy (Wales) and the supplementary TANs.
- UK
 - *Protection of Wrecks Act (PWA) 1973*. This legislation secures the statutory protection of wrecks within designated areas in territorial waters (i.e. within the 12 nautical mile (nm) limit), and protects those sites from interference by unauthorised persons. Under the Act, it is an offence to carry out certain activities on or in proximity to the wreck, unless a licence has been obtained from the UK Government. No protected wreck sites have been identified within the Offshore Development Area;
 - *Protection of Military Remains Act (PMRA) 1986*. This act provides protection for the wreckage of military aircraft and certain military wrecks. Designations, as Controlled Sites or Protected Places, restrict access whilst any operations that might disturb the site must be licensed by the Ministry of Defence. Under the Act, diving is permissible at a Protected Place, though it is an offence to tamper, move or remove any remains that may be deemed sensitive. Diving, salvage and excavation are prohibited on Controlled Sites except under licence. All military aircraft are automatically protected under this legislation; vessels are designated individually. At present no wrecks or military aircraft protected under the PMRA have been identified in proximity to the proposed Project;
 - *Marine and Coastal Access Act (MCAA) 2009*. This Act sets out a framework for the management of marine functions and activities in waters in or adjacent to the UK and its coastal areas, up to the seaward limits of the territorial sea. It legislates for the preparation and adoption of marine plans and for the regulation of licensable activities in the marine environment through the grant and enforcement of conditions on marine licences. Marine licences in Wales are administered by Natural Resources Wales (NRW);
 - *Merchant Shipping Act 1995*. The ownership of finds recovered from the sea is determined in the UK by the Receiver of Wreck (RoW), under the auspices of the Merchant Shipping Act. The Act applies to all finds of wreck in UK territorial waters, or to finds recovered from beyond the 12 nm limit but subsequently brought into territorial waters. Should any material which falls within the legal definition of 'wreck' be recovered during works associated with the proposed project the RoW must be notified, following the procedures outlined in the project-specific protocol for archaeological discoveries (PAD);
 - *Burial Act 1857*. This Act is supplemented by the Treasure (Designation) Order 2002. Finders of gold and silver objects more than 300 years old and prehistoric base metal assemblages, as defined in the Act, are required to report and deliver such finds to the Coroner;
 - *Ancient Monuments and Archaeological Areas Act 1979*. This Act provides protection for sites and monuments considered to be of national importance, including those



found in UK territorial waters and in the intertidal zone. Nationally important sites are protected through designation within the schedule of monuments defined under this Act. Unless authorised to do so, it is an offence to damage or carry out a range of specified activities on a scheduled monument. No scheduled monuments have been identified within the Offshore Development Area;

- *UK Marine Policy Statement (HM Government 2011)*. Paragraphs 2.6.6.1 to 2.6.6.9 of the UK Marine Policy Statement (MPS; 2011) state that the marine historic environment includes all aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged. It recognises that these assets are a finite and irreplaceable resource, and should therefore be conserved in a manner appropriate and proportionate to their significance. This includes both preservation in-situ and preservation by record. Significantly, the MPS also states that undesignated heritage assets should be afforded similar protection to designated assets; and
- *National Policy Statements*. The UK Government's policy for the delivery of major energy infrastructure is set out in the Overarching National Policy Statement for Energy (EN-1; Department of Energy & Net Zero (DENZ) 2023a), and the National Policy Statement for Renewable Energy Infrastructure (EN-3; DENZ 2023b). The original policies were published in 2011; revised versions were adopted in January 2024. NPS EN-1 highlights potential adverse impacts on the historic environment from installation, operation and decommissioning of energy infrastructure and states that projects must demonstrate that the significance of heritage assets (and their settings) and potential impacts upon them have been identified, minimised and mitigated adequately. NPS EN-3 similarly highlights the need to avoid adverse impacts on identified cultural heritage assets, including those located offshore. It is suggested that the most effective means of protection is the establishment of archaeological exclusion zones (AEZs).
- International
 - European Convention on the Protection of the Archaeological Heritage (Valetta) 1992;
 - UNESCO Convention on the Protection of the Underwater Cultural Heritage (2001);
 - United Nations Convention on the Law of the Sea (UNCLOS) 1982;
 - International Council of Monuments and Sites (ICOMOS) Charter on the Protection and Management of Underwater Cultural Heritage (1996) (the Sofia Charter);
 - The European Convention of the Archaeological Heritage of Europe (Revised) 1992; and
 - The World Heritage Convention.

11. All assessments were compiled in line with industry best-practice and relevant offshore renewables and marine historic environment guidance, including:

- Chartered Institute for Archaeologists (CIfA) guidelines: *Standard & guidance for archaeological desk-based assessment* (2014);
- *Managing the marine historic environment of Wales*, Cadw (2020);
- *Technical Advice Note 24: the historic environment*, Welsh government (2017);
- *The marine historic and natural environment marine area statement*, NRW and the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW; 2022);



- *Heritage impact assessment in Wales*, Cadw (2017a);
- *Setting of historic assets in Wales*, Cadw (2017b);
- *Conservation principles for the sustainable management of the historic environment in Wales*, Cadw (2011);
- Joint Nautical Archaeology Policy Committee (JNAPC) *Code of practice for seabed development* (1998);
- COWRIE *Historic environment guidance for the offshore renewable energy sector* (2007);
- COWRIE *Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy* (2008);
- COWRIE *Guidance for offshore geotechnical investigations and historic environment analysis: guidance for the renewable energy sector* (2011);
- *The design manual for roads and bridges* (Standards for highways 2019);
- *Offshore renewables protocol for archaeological discoveries*, the Crown Estate and Wessex Archaeology (2014); and
- *Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects*, the Crown Estate and Wessex Archaeology (2021).

24.3.3. Consultation with Statutory Bodies

12. For this assessment, the primary statutory bodies consulted were the RCAHMW and the Dyfed Archaeological Trust (DAT). This included a stakeholder meeting on 28 March 2023 with representatives from the RCAHMW, the Applicant and Coracle Archaeology, and email and telephone consultations with representatives of DAT. Further telephone and email consultations were held between the RCAHMW and Coracle in November 2023 and January 2024, with an additional online meeting with the RCAHMW in April 2024.

24.4 Methods and Data Sources

13. The following section sets out the methods followed for each assessment of marine archaeological and environmental data, including geographical scope and the sources used for the collation of data.

24.4.4. Desk-Based Assessment

Geographical Scope

14. The DBA assessed the Offshore Development Area, encompassing the Array Area and the proposed OfECC, to MHWS at Freshwater West. It also assessed a WSA which extended a further 1 km beyond the Array Area and 500m either side of the OfECC (**Volume 5: Figure 24C-2**). The WSA enabled an assessment of the archaeological potential of the area, whilst highlighting notable sites in the vicinity of the proposed Project. The purpose of the DBA was to identify known and potential sites within the Offshore Development Area that may be affected by the proposed Project.

Sources

15. The DBA included a documentary and cartographic search utilising a variety of sources to locate all known cultural heritage assets within the Offshore Development Area, and to identify the archaeological potential of the area. Sources utilised for the assessment included:
 - Wales
 - RCAHMW National Monuments Records of Wales (NMRW);



- DAT Historic Environment Records (HER);
- Cadw's Register of Historic Landscapes;
- records held by the National Museum of Wales (NMW); and
- geophysical survey data held by the integrated marine data and information system (iMarDIS), University of Bangor.
- UK-wide
 - records of wrecks and obstructions as held by the United Kingdom Hydrographic Office (UKHO) Admiralty Marine Data Portal;
 - UKHO review of cartography, historic charts and sailing directions;
 - UK-wide historic maps and charts as held by the National Library of Scotland (NLS);
 - records held by the Archaeology Data Service (ADS);
 - Marine Environment Data Information Network (MEDIN);
 - British Geological Survey (BGS) regional guide and previous work in the area;
 - readily accessible published sources and grey literature (e.g. results from previous studies); and
 - relevant strategic environmental assessment (SEA) reports (e.g. UK Continental Shelf SEA archaeological baseline) and coastal survey assessment reports.
- International
 - European Marine Observation and Data Network (EMODnet); and
 - Wrecksite.eu website.

24.4.5. *Assessment Methodology*

16. The DBA included all known and potential maritime cultural heritage assets, identified during the assessment. Records located within the Offshore Development Area and WSA were assigned a unique Coracle Archaeology (CA) number for ease of identification (in the format **CA00 ff**).
17. Route revisions mean that assigned CA numbers no longer run concurrently. Eight previously identified assets were located in older iterations of the Offshore Development Area, but are now located outside it. These comprise assets **CA3-5**, **CA11**, **CA35**, **CA40** and **CA44-45**. These will not be considered in this report (see **Annex 24C-A** for a summary table of these assets, and those located within the WSA). Two assets were originally reported in the WSA but fall within the revised Offshore Development Area (**CA60** and **CA64**); two additional assets (**CA65-66**) were identified within the latest route iteration, and included here.
18. The project GIS used World Geodetic System 1984 (WGS84) Universal Transverse Mercator (UTM) 30N (European Petroleum Survey Group [EPSG] projection 32630). Geospatial data for the Offshore Development Area were supplied by the client in WGS84 (ESPG projection 4326), as were data from the UKHO Admiralty Marine Data Portal. Data from these two sources were projected into the GIS without transformation.
19. For initial iterations of the OfECC, geospatial data from the RCAHMW NMRW and from the Dyfed HER were transformed from Ordnance Survey Great Britain 1936 (OSGB36; EPSG projection 27700) into WGS84 (EPSG projection 4326), using the transformation OSGB 1936 to WGS 1984 Petroleum (EPSG transformation 1314), which has a stated accuracy of $\pm 2\text{m}$. Transformed and projected data were then clipped using a 500m wide buffer around the



OfECC, and a 1 km buffer around the Array Area. The Offshore Development Area and WSA was clipped at MHWS.

20. Following the route revision in April 2024, the most recent publicly available version of the RCAHMW NMRW (January 2024) was obtained via the Datamap Wales portal. This dataset was supplied in WGS84 (EPSG 4326) and required no transformation for projection into the GIS. Supplemental records from the Dyfed HER were acquired via the Archwilio data portal and transformed from OSGB36 using the Ordnance Survey's online coordinate transformation tool. Newly and previously-acquired datasets for earlier route iterations were then clipped to the new Offshore Development Area and WSA, as appropriate. This resulted in the exclusion of a number of assets from this assessment, and the addition of others. Where necessary, omissions are highlighted below.

24.4.6. *Marine Geophysical Survey*

Data Acquisition

21. Marine geophysical surveys were undertaken by N-SEA between September and December 2022, using the survey vessels *Braveheart Spirit* (offshore) and *Coastal Observer* (inshore, within the Milford Haven port limits). The surveys covered the entirety of the Array Area and a corridor within the OfECC. These surveys were conducted along an earlier iteration of the OfECC. Consequently, there are gaps currently in the nearshore geophysical survey coverage and therefore in the assessment presented below (**Volume 5: Figure 24C-3**). Further surveys are required to assess the revised OfECC; these will include the collection of additional MBES, SSS, SBP and marine magnetometer data. It is anticipated that these will be undertaken post-consent. These will require archaeological assessment, following the methodologies outlined in Coracle Archaeology (2024b) to ensure that the marine archaeology and cultural heritage within the Offshore Development Area has been fully assessed. Discussions with the RCAHMW in March 2024 indicated that the archaeological assessment of these data is likely to form a condition of consent. Completion of those assessments, to the satisfaction of the RCAHMW, will be carried out prior to installation.
22. Bathymetric data for the offshore survey area were acquired from the *Braveheart Spirit* using a Kongsberg EM2040-04 MBES, with backscatter data collected using a R2 Sonic 2024 MBES. Sound velocity (SV) probes were used to perform regular sound velocity casts, with one cast every 24 hours. SSS survey was undertaken using a Klein MA-X VIEW 600, and SBP data were collected using an Edgetech 2050-DSS. The magnetometer survey was undertaken using a Geometrics G882 caesium vapour magnetometer. Positioning data were acquired using a Starpack Omnistar (XP2 PPP), with sub-sea positioning of towed sensors accomplished using the HiPAP 501 ultra-short baseline (USBL) system. The transducer was used in conjunction with a Kongsberg C-Node MiniS and Maxi.
23. Bathymetry and backscatter data were acquired within the Milford Haven port limits by *Coastal Observer* using a Norbit B41 Winghead MBES. SSS data were acquired using an Edgetech 4125, and SBP data using a Geo-pulse 5430 A. The magnetometer survey was undertaken using a Geometrics G882 caesium vapour magnetometer, with onboard positioning provided by an Applanix PosMV Wavemaster 2. Sub-sea positioning of towed sensors was accomplished using a Sonardyne Mini Ranger 2 USBL system, in conjunction with the Sonardyne WSM 6+ x2. Full details of survey specification and methodology can be found in N-SEA (2023).



Geodetic and Projection Parameters and Vertical Datum

24. Survey positions were recorded in the geodetic datum WGS84, with projection in UTM Zone 30 North. The vertical reference level is LAT, with MBES elevation corrected using the UKHO vertical offshore reference frames (VORF). Predicted tides were extracted from Total Tide, a tidal prediction program issued by the UKHO (N-SEA 2023).

Archaeological Assessment Methodology

25. Geophysical assessment was undertaken using Coda Octopus Survey Engine 4.3 and ArcGIS 10.8 software. SSS and SBP data were analysed using the former, with the positions of surface and sub-surface anomalies exported in shapefiles and uploaded into ArcGIS alongside processed magnetometer data, following the guidelines of Plets *et al.* (2013). MBES data were provided at a gridded resolution of 0.25m. This was supplemented by additional bathymetry data from the UKHO Civil Hydrography Programme (survey HI328), which was used to assess both the survey area and areas immediately adjacent. These data were collected in 2011 and gridded at 2-4m resolution.
26. The assessed data exceeded minimum requirements (see Plets *et al.* 2013), with SSS data meeting 200 percent coverage across the entire survey area and the bathymetry survey exceeding International Hydrographic Organization (IHO) Special Order 1 specifications (processed to a 0.25m resolution). The data were therefore of sufficient quality to permit detailed archaeological assessment of geophysical anomalies identified within the survey area.
27. The geophysical datasets were assessed for anomalies with archaeological potential, with selection based on the presence of multiple lines of evidence (confirming datasets). Anomalies were defined based on their potential to be of archaeological interest, and have been classified using the following criteria:
 - **High potential** - typically identified by multiple geophysical datasets and can be identified positively as being an archaeological site (e.g. Wreck) or of archaeological interest;
 - **Medium potential** - typically identified by multiple geophysical datasets, and strongly suggestive of the presence of anthropogenic feature(s) which may be of archaeological interest, but cannot be classified or identified visually (e.g. Cannot be identified positively as a wreck);
 - **Low potential** - usually identified by a single geophysical dataset (typically magnetics and / or sss) that suggest a possible anthropogenic feature that may have archaeological significance and that differs in character from those targets identified as having no potential; or
 - **No potential** - geological features such as boulders or known (and often mapped) anthropogenic features such as cables, anchorages etc.
28. All geophysical anomalies assessed as being of high, medium or low archaeological potential were assigned a unique Coracle Archaeology number (>**CA1000**). A full gazetteer of geophysical anomalies with archaeological potential identified within the latest iteration of the Offshore Development Area assessment is provided in **Annex 24C-B**; details of all anomalies assessed to date (including those located in subsequent redundant survey areas) can be found in Coracle Archaeology (2024b).
29. Any known and located historic assets and geophysical anomalies identified as being of high or medium archaeological potential within the survey area are protected through the imposition of AEZs. These are areas imposed for the in-situ protection of cultural heritage



assets, in which any works that disturb the seabed are strictly prohibited. It is possible nevertheless to work over them, or to sail through them.

30. The suggested extent of each AEZ is the radius of a circle centred on the given location and based on the available geophysical data for each anomaly, including the lateral distribution of visible features, the extent and direction of scour, and the likelihood for debris to have spread away from the site (the debris field). They have been designed to encompass all debris / structure visible on the seabed, with an added dimension to protect adequately both potentially buried remains and the potential for mobile debris associated with the direction (and extent) of the scour.
31. AEZs were defined following professional recommendations (Dix *et al.* 2007) and converted into circular AEZs with a defined centre point to encapsulate the required exclusion zone. The extent of the suggested circular AEZ is therefore sufficiently large to encompass the area that would be defined by a polygon, following the procedures outlined in Dix *et al.* (2007).
32. The use of a centre point and set radius has been deemed the most robust method when attempting to incorporate AEZs into different vessel navigation systems. This reduces the risk of accidental incursions into AEZs during site works, and possible impacts on the potential asset within. In accordance with sections 5.1 and 5.2 of *Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects* (which advocates preservation in-situ with the aid of AEZs; The Crown Estate & Wessex Archaeology 2021), the extent of the AEZ is based not only on the perceived archaeological potential of the asset, but also on its extent, where known.

24.4.7. Landfall Surveys

Data Acquisition

33. Landfall surveys were undertaken in May 2023 at Freshwater West, Pembrokeshire. The surveys were conducted on the foreshore and in the intertidal zone, from MHWS on the most favourable spring tides. Spring tides occur following a new or full moon, and exhibit the greatest difference between high and low water; this ensured as much continuity as possible with the marine geophysical survey datasets. The purpose of these archaeological assessments was to identify known and potential sites and features of archaeological interest at the landfall location that may be impacted by the proposed Project.
34. The surveys were conducted at two potential OfECC landfall locations, including both a southern and a northern option (**Volume 5: Figure 24C-4**); the latter has now been selected as the preferred option. A 300m survey grid was established at the southern location, extending 150m either side of the proposed cable centreline. This was subsequently subdivided into 5m transects, using a Global Positioning System (GPS) with an accuracy of ≤ 0.5 m. The surveys, comprising electro-magnetic conductivity, hand-held metal detector and walkover surveys, were conducted along these transects, parallel to the retreating waterline. The northern survey area extended 150m to the south of the proposed cable centreline; it was constrained by the presence of rocks and cliffs at the northern extent (**Volume 5: Figure 24C-4**). The longest transect in the northern survey area was c. 250m, the shortest c. 100m. The majority of transects measured between c. 180m and 200m.
35. Landfall geophysical survey was conducted using a Geophex GEM-2 multi-frequency broadband electro-magnetic (EM) instrument. The GEM-2 is a non-intrusive frequency-domain electrical conductivity measuring device that records the spatial variations of apparent ground conductivity of the earth in units of milliSiemens / metre (mS/m). The 'siemen' is the



international unit of measurement for volume electrical conductance and is the equivalent to an ampere / volt. The system provides two measurements:

- Quadrature (apparent conductivity); and
- In-phase data (metallic response).

36. The GEM-2 can acquire data over multiple frequencies, which is equivalent to measuring the earth's response from multiple depths (depending on the earth medium targeted). Five frequencies were utilised and analysed subsequently at Freshwater West (1525 Hertz (Hz), 2825 Hz, 5275 Hz, 9825 Hz and 18325 Hz).
37. A Minelab X-Terra 705 instrument was used to conduct the metal detector surveys. The metal detector was set to detect all metal, with the sensitivity adjusted to compensate for the high salt content of the beach sand. Any find locations identified during the walkover surveys were recorded using a hand-held GPS.

Assessment Methodology

Geophysics

38. The primary focus of the landfall geophysical survey was to identify buried objects that might relate to heritage assets. In addition, variations in silting patterns in the foreshore area were mapped, where possible. These variations may occur in areas where timber structures have influenced the deposition of sediments and could therefore be used to identify the presence of wood, potentially indicative of wreck material or other wooden structures buried in the sand.
39. Furthermore, as ground conductivity is influenced by soil moisture content, an electromagnetic conductivity survey can be used to differentiate between areas of solid substrata and sand. This enables some analysis of the former physical topography of the survey area, by identifying channels or basins in the sub-strata. Identification of these features may define areas of archaeological potential in the survey area.
40. The data were recorded digitally and downloaded periodically to a field computer for quality assurance and preliminary interpretation. At the conclusion of the survey, the Geophex GEM-2 data were interpreted and mapped using Terrasurveyor V3.0.32.4, a surface mapping software that enables topographic data to be contoured and presented in a manner that facilitates interpretation of sub-surface features. The landfall geophysical survey was completed in accordance with relevant best practice guidance documents (e.g. Gaffney *et al.* 2002; David *et al.* 2008; Bonsall *et al.* 2014; Schmidt *et al.* 2015).

Metal-Detector and Walkover Surveys

41. All identified features and detected find spots were recorded photographically with a brief description, if required. Numeric values displayed on the metal-detector were also recorded; these have the potential to identify the type of metal detected, with higher values more likely to be indicative of non-ferrous metals (Minelab 2017: 11). Locations were recorded using a hand-held GPS and were then plotted into ArcGIS. As the surveys were non-intrusive, no find spots were excavated.

24.5 Results

24.5.8. Submerged Prehistory and Palaeo-Environmental Baseline Assessment

42. The following section outlines the nature of the existing environment in proximity to the proposed Project, through a review of available data and published sources. It assists in the



analysis of landfall, seabed and sub-seabed deposits and enables the identification of those likely to be of palaeo-environmental and geoarchaeological interest.

43. Throughout the Late Devensian period (c. 60 to 11.5 kilo annum (ka)), the British-Irish Ice Sheet (BIIS) was the dominant feature determining the palaeo-climate and depositional history of the area (Clark *et al.* 2012; Chiverrell *et al.* 2013; Scourse *et al.* 2019). The ice sheet reached its maximum extent in the Celtic Sea at c. 24.3-23 ka, extending to a position west of the Isles of Scilly, though it is noteworthy that southern Pembrokeshire is believed to have remained ice-free (Chiverrell *et al.* 2013; John 2019).
44. Following this maximum extension, the BIIS began to regress towards the northern Irish Sea Basin; the retreat was rapid and driven by climatic warming, sea-level rise, mega-tidal amplitudes and reactivation of meridional circulation in the North Atlantic. The extension and retreat of the BIIS along St George's Channel and into the Celtic Sea resulted in the deposition of thick Pleistocene deposits (Blundell *et al.* 1968; Garrad 1977), typically associated with the Cardigan Bay Formation.
45. The BIIS was the last in a series of major glaciations that took place throughout the Pleistocene (c. 2.5 million years ago to 11.5 ka). There remains, however, considerable uncertainty over the extent of Pleistocene ice sheets in the area of the proposed Project. It was suggested by both Stephens (1966) and Mitchell (1968) that the geomorphology of the island of Lundy may be a product of glacial processes, modified by periglacial and post-glacial surface processes. This included widespread smoothing and lineation of granite bedrock surfaces, potentially indicative of sub-glacial ice moulding, dry channels interpreted as subglacial meltwater channels, and the presence of large areas of erratic gravels and cobbles, typically seen as representative of transport by ice. It was argued therefore by Mitchell (1968; 1972) that the last glaciation over Lundy occurred during either the Anglian glaciation (Marine Isotope Stage (MIS) 12; c. 478-424 ka), or the Wolstonian (MIS 10 to 6; c. 352- 130 ka).
46. Recent investigations (e.g. Rolfe *et al.* 2012; 2014; Rolfe 2015) have challenged this assumption. Utilising Aluminium-26 (^{26}Al) / Beryllium-10 (^{10}Be) cosmogenic exposure dating of the glaciated bedrock surfaces, it is suggested that the last glaciation of Lundy occurred at c. 40-35 ka, or during MIS 4-3. This too has been challenged by Carr *et al.* (2017), based on a revised interpretation of the geomorphological and cosmogenic exposure data. It is argued that Lundy remained ice-free during the Devensian glaciation, with the cosmogenic dates relating to surface lowering during a prolonged period of sub-aerial granite weathering. Ongoing investigations on Lundy nevertheless continue to support MIS 4 glaciation, with deglaciation in MIS 3.
47. Offshore, glacial deposits from the north-east of Lundy were evaluated by Gibbard *et al.* (2017), using borehole data collected for the Atlantic Array offshore wind farm, c. 26 km east of the proposed Project, supplemented with coarse-resolution bathymetric data (based on EMODnet DTM at $1/8 * 1/8$ minutes resolution). It was suggested that glacial till deposits were present below marine deposits, lending credence to the suggestion that these deposits might be associated with the Upper Till Member of the Cardigan Bay Formation (Tappin *et al.* 1994).
48. Detailed analysis of the offshore borehole deposits has, however, yet to be undertaken (e.g. Carr *et al.* 2017), and the interpretation of the glacial sediments remains unsubstantiated. It is notable that the seabed south of Lundy does not contain any visible gorge-like features or moraine deposits, potentially indicative of grounded ice. Rather, bedrock is incised by an east-west palaeo-channel network, likely associated with lowstand drainage from the Taw-Torridge valleys in north Devon.



49. It is suggested nevertheless by Gibbard *et al.* (2017) that the north-east Celtic Sea witnessed at least three phases of glaciation - one related to the southern limits of a Late Devensian MIS 2 Welsh Ice Cap, an earlier Devensian glaciation (MIS 4–3), associated with the BIIS, and a third, older glaciation associated with ice that filled both the eastern Celtic Sea and the outer and central Bristol Channel.
50. The latter is attributed typically to the Caernarfon Bay Formation, and is likely associated with onshore deposits recorded at Fremington, north Devon. This is refuted by Carr *et al.* (2017), who prefer instead the existing model of the extent, dynamics and timing of the BIIS, highlighted by both McCarroll *et al.* (2010) and Clark *et al.* (2012). This model places the BIIS significantly to the west of Lundy, and not extending beyond the Celtic Sea or reaching the northern coastline of Cornwall and Devon.
51. Using this model, the proposed Project lies at the eastern extent of the MIS 2 glacial limit, though a revision by Chiverrell *et al.* (2013) places this limit c. 15 km east of the Array Area, crossing the Offshore Development Area c. 26 km to the north of the array (see Coracle Archaeology 2024a). It is possible, therefore, that an ice sheet may have extended to the east of Lundy during the mid- to late-Devensian period, into the OfECC.
52. The retreat of the BIIS and the concomitant rise in sea levels resulted in the submersion of coastal areas adjacent to the Celtic Sea. The rate of change in relative sea-level (RSL) has been constrained by studies using sea level index points (SLIPs). The most recent review of SLIPs for the British Isles (Shennan *et al.* 2018) highlights only one SLIP for south Wales, derived from the submerged forest deposits at Freshwater West.
53. To supplement the radiocarbon-dated SLIPs, glacial isostatic adjustment (GIA) models have been used to predict broad patterns of RSL change over longer periods. GIA models predict sea levels of c. 30m below mean sea-level (MSL) at the start of the Holocene (11.7 ka), rapidly rising to c. 8m below MSL at Freshwater West by c. 7-8 ka, with a subsequent reduced rate of RSL rise to the present day.
54. Further offshore, RSL has been modelled in St George's Channel and combined with tidal amplitude data for sectors of the BIIS since the Last Glacial Maximum (LGM) at c. 22 ka. At the approximate position of the glacial limit, Scourse *et al.* (2018) suggest that RSL was c. 60m below MSL between 20 to 14 ka, rising to c. 40m below MSL at the end of the last glaciation, before following the Holocene curves predicted for Pembrokeshire. The modelled RSL suggests that the land bridge between Wales and Ireland in St George's Channel disappeared with the retreat of the BIIS.
55. The RSL history of the area (based on Scourse *et al.* 2018) suggests that the proposed Array Area would have been inundated during MIS 2. Following the models for the BIIS proposed by both Gibbard *et al.* (2017) and Chiverrell *et al.* (2013), it is also likely to have been beneath ice prior to inundation, further reducing the potential of the area to reveal any evidence for submerged palaeo-landscapes suitable for human occupation (see also Coracle Archaeology 2024a).
56. Indeed, the survival potential for palaeo-environmental material associated with submerged palaeo-landscapes in this area of the Celtic Sea is generally regarded as relatively low, primarily as a result of high-energy conditions including strong tidal currents which sweep through St. George's Channel, to the northwest of the proposed Project. Such conditions are reflected on the seabed by lag gravel deposits or scoured bedrock, and result in minimal preservation of former landscapes. Exceptions, however, can occur, in the form of infilled depressions (including palaeo-channels) which may have collected and protected material (Westley and Edwards 2017).



57. Though the area is unlikely to contain evidence for submerged palaeo-landscapes suitable for human occupation, sedimentary sequences found within the Offshore Development Area do have the potential to test competing hypotheses over the presence and extent of Devensian glaciation. The archaeological and palaeo-environmental significance of these deposits cannot, therefore, be discounted.
58. The palaeo-environmental potential of the landfall location at Freshwater West is somewhat better understood (Coracle Archaeology 2024 a; **Volume 5: Figure 24C-5**). Leach (1913) first identified two areas of submerged forest on the beach in the spring and summer of 1912, along with a number of flint flakes and pieces of hard, brittle charcoal, beneath previously undisturbed peat deposits. These were interpreted as the remains of a fire and flint ‘chipping’ floor.
59. The most westerly (seaward) of the peat deposits was reinvestigated in the summer of 1960 by Wainwright (1961; 1963; **Volume 5: Figure 24C-5**), who also encountered one small tranchet axe and a few flint flakes from the surface of the blue clay, sealed by the peat. Sampling of the peat at the low water mark by Godwin suggested that the pollen assemblage was dominated by *Quercus* (oak) and *Alnus glutinosa* (alder), with the latter also present in the macrofossil record along with a series of other aquatic / wetland plant species (in Wainwright 1961; 1963 Appendix II). The macrofossils indicated a transition from fen woodland at the base of the sequence to ‘more muddy conditions’ at the top. The lower wood peat was radiocarbon dated to 5210-4550 calibrated (cal) BC (Q-530; 5960±120 BP; Godwin & Switsur 1964).
60. It is noteworthy that geo-rectification of the map produced by Leach (1913; **Volume 5: Figure 24C-5**), coupled with the site descriptions provided by Wainwright (1959; 1961; 1963), centres the most seaward submerged forest exposure and occupation surface on OSGB grid reference SR 8805 9969 (WGS84 UTM 30 N 357120; 5724790), c. 350m west of the position of the forest recorded by the RCAHMW (national primary reference number (NPRN) 524740; **Volume 5: Figure 24C-5**). The landward submerged forest exposure is mapped by Leach (1913) on SR 8832 9973 (WGS84 UTM 30 N 357390 5724840), c. 120m south of its recorded position. This peat surface is often exposed on the beach following storm activity when the sand is stripped away temporarily, most recently in 2016 and 2020 (Mountain Man 2023).
61. In April 2021, a peat bed with tree remains and an underlying brown soil were reported at SR 88370 99784 (WGS84 UTM 30 N 357435; 5724891), covering an area of c. 20m x 50m. This peat surface is likely to be associated with the inner submerged forest exposure. This location is 90m south of the RCAHMW record and 60m northeast of the approximate position provided by Leach (1913), suggesting that the submerged forest is more laterally extensive than considered previously.
62. At Gravel Bay, at the northern end of the beach, a newly recorded submerged forest was reported in March 2020 (Mountain Man 2023). This consisted of an undulating peat surface with abundant pools and occasional tree remains, extending over an area of c. 100 x 30m, centred on SN 8806 0047 (WGS84 UTM 30 N 357116; 5725573; **Volume 5: Figure 24C-5**). These peats are not recorded in the NMRW or DAT HER datasets.
63. The PaMELA database (Palaeolithic and Mesolithic Lithic Artefact database; Wessex Archaeology & Jacobi 2014) also includes a large number of locations with Mesolithic material in and around the beach at Freshwater West. Most of these records are, however, spatially inaccurate and appear to relate to the submerged forest identified by Leach or excavations by Wainwright in the Little Furznip / Gupton Burrows area.



- 64. The PaMELA database does, however, cite a collection at the Ashmolean Museum recorded as derived from Broomhill Burrows, the dune sequence to the north of the Castlemartin Corse stream that enters the bay to the east of the submerged forest. The ‘soil drift’ deposit may extend under the beach, and into the Celtic Sea, though this is not visible in the iMarDIS MBES dataset, collected in 2017, which shows mainly undifferentiated seabed sand and bedrock outcrops. At present, no seismic data (sub-bottom profiler) is available for the intertidal and nearshore area that may give an indication of the lateral continuity of buried deposits. The presence of a number of submerged forest deposits (including artefact-rich sediments), combined with flint scatters recorded on the beach, nevertheless suggests that the possibility of encountering in-situ archaeological or palaeo-environmental material during works at Freshwater West cannot be discounted.

24.5.9. *Archaeological Assessments*

Summary

- 65. The DBA recorded 41 cultural heritage assets in the Offshore Development Area, including 25 wrecks, two aircraft, two obstructions, one maritime named location, four findspots, three sites, one monument, two features and one geophysical anomaly identified by previous surveys in the area (**Table 24C-1**). Following revisions to the OfECC, eight previously identified assets are now located beyond the Offshore Development Area, including **CA3-5, CA11, CA35, CA40 and CA44-45**. These will not be considered in this report (though see **Annex 24 C-A** for a summary table).
- 66. There are no World Heritage Sites, Scheduled Monuments, Protected Wreck Sites, Registered Parks and Gardens, or Registered Battlefields within the Offshore Development Area. The proposed Project does, however, intersect the Milford Haven Waterway Historic Landscape Area, principally the West Angle to Freshwater West coastal strip.
- 67. Twenty-nine geophysical anomalies with archaeological potential were identified in the supplied marine geophysical survey data for a previous iteration of the Offshore Development Area. Of these, five are considered to be of high and 12 of medium archaeological potential. Four of the anomalies of high archaeological potential correspond to live wrecks, recorded in an earlier version of the DBA. A full gazetteer of all geophysical anomalies identified during archaeological assessments undertaken for the project, including those located within now redundant sections of the OfECC, can be found in Coracle Archaeology (2024b).

Table 24C-1. Sites of cultural heritage interest in the Llŷr Offshore Development Area identified by the DBA and categorized by general type

Type	Total
Wreck	25
Aircraft	2
Obstruction	2
Maritime named location	1
Findspot	4
Sites	3
Monument	1
Feature	2
Anomaly	1
Total	41

- 68. This report focuses solely on the latest iteration of the Offshore Development Area, incorporating the revised OfECC. Only four anomalies with archaeological potential are



located within the revised boundaries of the Offshore Development Area, including one of high, two of medium, and one of low, archaeological potential (see **Annex 24C-B**). The anomaly considered to be of high archaeological potential comprises a clearly visible shipwreck (**CA1025**), c. 38m long and largely intact and upstanding, corresponding to the location of an unknown wreck reported in the DBA (**CA6**). AEZs have been proposed around anomalies considered of high or medium archaeological potential, ranging in radius from 30-75 m (**Table 24C-2**). The remaining anomaly consists of a single magnetic anomaly with no corresponding signature in the SSS, MBES or SBP datasets. The anomaly is located close to a series of boulders; it is considered of low archaeological potential and no AEZ is deemed necessary. It is not considered further in this report.

- 69. Other geophysical anomalies identified in the survey data include small (<2 m) boulders, often with associated scour. These anomalies did not have an associated magnetic signal and are considered natural in origin. A number of in-service and out-of-service cables were also identified within the survey, including those making landfall at Freshwater West; these are not considered in this archaeological assessment.
- 70. At the time of writing, no survey data is available for the revised OfECC (**Volume 5: Figure 24C-3**). The Applicant has committed to an archaeological review of collected marine geophysical data for the OfECC post-submission, following the methodology outlined in Coracle Archaeology (2024b). This will result in a revised *Archaeological assessment of marine geophysical and landfall survey data*, which will be submitted to the RCAHMW for their review and comment. This assessment will then be incorporated into the written scheme of investigation (WSI) alongside the other project-specific assessments.
- 71. Walkover, metal-detecting and geophysical surveys conducted at both proposed landfall locations at Freshwater West did not identify any new sites or palaeo-landscape features with archaeological potential, nor did they locate any of the cultural heritage assets identified in the DBA. A linear anomaly running approximately north south-west / north-east is, however, visible in the EM data from the northern survey area (the preferred option); this was identified as a relict Ministry of Defence (MoD) listening cable.
- 72. Two further AEZs are proposed around the known location of wrecks. One of these is located on the foreshore, within the southern landfall option (**CA2; Table 24C-2**). This was not visible at the time of survey, presumably as a result of elevated levels of mobile beach sediment. The remaining AEZ is proposed around the recorded location of the SS *Saint Jacques* (**CA65**), a live wreck visible in high-resolution bathymetry data hosted on the iMarDIS portal but for which there is presently no project-specific geophysical survey data.

Table 24C-2. Proposed archaeological exclusion zones

CA no.	Easting UTM 30 N	Northing UTM 30 N	Description	Archaeological potential	Proposed AEZ radius
CA2	357165	5725301	<i>Willemoes of Thuro</i>	High	50 m
1025	334581	5701370	Clearly visible wreck, aligned N-S, associated with SSS anomalies, with bow pointing south. Wreck appears largely intact, measuring 38 x 9 x 3.5 m, with hull and superstructure appearing to be intact. Scour is present at the stern and bow, with some W-E scour also evident. Associated with magnetic anomaly of 279 nT. The location corresponds to the recorded location of CA6	High	75 m



CA no.	Easting UTM 30 N	Northing UTM 30 N	Description	Archaeological potential	Proposed AEZ radius
1026	333161	5696796	A group of SSS anomalies up to 1.5 m, within an area of scour between bedforms, measuring 15 x 14 x 0.3 m	Medium	30 m
1029	340382	5685354	Magnetic anomalies of 255 nT and 21 nT	Medium	40 m
CA65	353793	5722953	SS <i>Saint Jacques</i>	High	75m

Cultural Heritage Assets in the Offshore Development Area

73. There are 41 non-designated heritage assets located in the Llŷr 1 Offshore Development Area (Volume 5: Figure 24C-6 to 24C-8; Table 24C-3). Full details of all gazetteer entries can be found in the DBA (Coracle Archaeology 2024a).

Table 24C-3. List of cultural heritage assets in the revised Offshore Development Area

CA no.	Name	Type	Date	Status	Easting (UTM 30N)	Northing (UTM 30N)	Source
1	<i>Highland Home</i>	Wreck*	1895	Live	354054	5725512	UKHO; RCAHMW
		Wreck (artefacts)			356766	5724240	RCAHMW
2	<i>Willemoes of Thuro</i>	Wreck	1924	Live	357165	5725301	RCAHMW
6	Unknown	Wreck	Unknown	Live	334513	5701421	RCAHMW
					334580	5701370	UKHO
7	Unknown	Wreck	Unknown	Dead	334174	5697983	UKHO
8	Submerged forest	Feature	Mesolithic	n/a	357411	5724974	RCAHMW
			Prehistoric	n/a	357274	5724404	Dyfed HER
9	Submerged forest	Feature	Prehistoric	n/a	357048	5725613	n/a
10	Occupation site	Site	Mesolithic	n/a	357169	5724802	Dyfed HER
12	Footprints	Monument	Prehistoric	n/a	357368	5724895	Dyfed HER
13	<i>Mary E Wadham</i>	Wreck	1888	Reported loss	357299	5724737	RCAHMW
14	<i>Georges Andre</i>	Wreck	1916	Reported loss	332026	5691342	RCAHMW
15	<i>Mysotis</i>	Wreck	1916	Reported loss	332026	5691342	RCAHMW
16	<i>Roger Bushell</i>	Wreck	1974	Reported loss	341684	5713649	RCAHMW
17	Freshwater West Maritime named location	Seascape	Multiperiod	n/a	357214	5725151	RCAHMW
18	<i>Brothers</i>	Wreck	1819	Reported loss	357214	5725151	RCAHMW
19	<i>Hope</i>	Wreck	1823	Reported loss	357214	5725151	RCAHMW
20	<i>Princess Elizabeth</i>	Wreck	1825	Reported loss	357214	5725151	RCAHMW



CA no.	Name	Type	Date	Status	Easting (UTM 30N)	Northing (UTM 30N)	Source
21	<i>Cherokee</i>	Wreck	1831	Reported loss	357214	5725151	RCAHMW
22	<i>Blessing</i>	Wreck	1834	Reported loss	357214	5725151	RCAHMW
23	<i>Express</i>	Wreck	1836	Reported loss	357214	5725151	RCAHMW
24	<i>Unknown</i>	Wreck	1840	Reported loss	357214	5725151	RCAHMW
25	<i>Dove</i>	Wreck	1841	Reported loss	357214	5725151	RCAHMW
26	<i>Mary Ann</i>	Wreck	1841	Reported loss	357214	5725151	RCAHMW
27	<i>Gram Para</i>	Wreck	1855	Reported loss	357214	5725151	RCAHMW
28	<i>Unknown</i>	Wreck	1860	Reported loss	357214	5725151	RCAHMW
29	<i>Thomas M Reed</i>	Wreck	1879	Reported loss	357214	5725151	RCAHMW
30	<i>Barabara</i>	Wreck	1881	Reported loss	357214	5725151	RCAHMW
31	<i>Astronomer</i>	Wreck	1886	Reported loss	357214	5725151	RCAHMW
32	<i>Margaret Ann</i>	Wreck	1918	Reported loss	357214	5725151	RCAHMW
33	<i>Vickers Wellington XII Mp638</i>	Aircraft	1944	Reported loss	357214	5725151	RCAHMW
					357269	5724804	Dyfed HER
34	<i>Armstrong Whitworth Whitley V Z6941</i>	Aircraft	1941	Reported loss	330696	5694525	RCAHMW
36	Unclassified	Obstruction	Unknown	Live	339350	5712607	RCAHMW
37	Unclassified	Obstruction	Unknown	Dead	325968	5695474	UKHO
38	Bronze hoard	Site	Bronze Age	n/a	357266	5725003	Dyfed HER
39	Landing point at Gumption Barrows Bridge	Site	Post Medieval	n/a	357499	5724870	RCAHMW
41	Prehistoric flint flake	Findspot	Prehistoric	n/a	357065	5725101	NMW
42	Red deer metapodial	Findspot	Prehistoric	n/a	357265	5725103	NMW
43	Arrowhead and Chert Pebble	Findspot	Bronze Age	n/a	357169	5724802	Dyfed HER
60	Bones	Findspot	Unknown	n/a	357078	5724101	Dyfed HER



CA no.	Name	Type	Date	Status	Easting (UTM 30N)	Northing (UTM 30N)	Source
64	<i>Hope</i>	Wreck	1901	Reported loss	354529	5719998	RCAHMMW
CA6 5	<i>Saint Jacques</i>	Wreck	1917	Live	353795	5722922	RCAHMMW; UKHO
					353793	5722953	
		Wreck (boiler?)	Unknown	Unknown	353827	5722936	
					353518	5722375	RCAHMMW
CA6 6	ERS21_010 6	Anomaly	Unknown	Live	337286	5710386	RCAHMMW

* Located outside of Offshore Development Area

74. The *Highland Home* was a British iron-hulled barque of 1371 gross registered tonnage (grt), built in Leith in 1886. On 10th November 1895, the vessel became separated from the steam tug *Warrior* while undertow, with the loss of 20 lives (wrecksite.eu). The wreck is located beyond the revised Offshore Development Area, at a depth of c. 21m below LAT (UKHO number 68924). The RCAHMMW also records a wreck at this location, though it is unnamed in its database (NPRN 240879). The archaeological review of marine geophysical survey data identified the wreck at this location, with visible wreckage covering an area of c. 80 x 46m (Coracle Archaeology 2024b).
75. Artefacts from the wreck, including the ship’s bell, have been recovered from a location c. 3 km to the south-east of the recorded position of the wreck (**CA1**; NPRN 273100; **Volume 5: Figure 24C-7**), within the Offshore Development Area. Both the location of the wreck and recovered artefacts are recorded in **Table 24C-3**. No geophysical survey data were available for the area in which the ship’s artefacts were recovered, though it would appear to be an isolated findspot. It is unlikely that further remains are to be found at this location. As the wreck itself clearly lies beyond the revised Offshore Development Area, it will not be considered further in this report.
76. One live wreck is recorded on the beach at Freshwater West, routinely exposed by winter storms (**Volume 5: Figure 24C-7**). The *Willemoes of Thuro* (**CA2**) was a wooden schooner of 186 grt, built at Svenburg in 1911 (NPRN 273193). This vessel ran ashore in December 1924 while on passage from Caernarfon to Erquy, with the loss of one life.
77. During the storms of December 2013 / 2014, c. 15.5m x 3.4m of the vessel was exposed, including a length of keel, outer planking fastened with iron pins and both main and filling frames (see Coracle Archaeology 2024a). An additional piece of timber and concretions were reported c. 20 m to the south. The vessel was previously known as the ‘upside-down wreck’ (NPRN 420445) before being positively identified as the *Willemoes* (coflein.gov.uk).
78. No remains of the wreck were visible on the surface at the time of the survey in May 2023, and no areas of high conductivity or magnetic susceptibility anomalies were identified in proximity to the recorded location of the *Willemoes* in the EM survey data, presumably as a result of elevated levels of beach sand. Following the precautionary principle, an AEZ of 50m has been assigned.



79. A north-south aligned wreck (**CA1025; Volume 5: Figure 24C-9**) is visible in project-specific geophysical data as well as high resolution MBES bathymetry hosted by the iMarDIS portal (Coracle Archaeology 2024b). The location of the wreck site corresponds with **CA6**, originally recorded as a sonar contact at the end of World War 2 (WWII). Scour is visible at the bow and stern of the vessel, up to 2m deep and extending up to 9m north and south of the wreck. Two large pieces of debris are also visible on the seabed, c. 7m and 1m west of the wreck, measuring c. 7m and 4m in length respectively. Both these linear features are likely to be part of the ship's rigging and may be the remains of beams or masts. Additional debris can be seen close to the stern of the wreck at its north-eastern end; a further cluster of debris is visible on the seabed c. 33m north-east of the stern.
80. Two magnetic anomalies are associated with this wreck site, measuring 279 nanoTesla (nT) and 43nT respectively. The former is suggestive of a large ferrous mass, with shorter wavelength dipoles associated with the smaller anomaly likely caused by debris.
81. The profile of the ship is indicative of a large open deck with mid-ship housing and a steam engine, though it is probable that it also carried a pair of masts or beams. It is likely that it is late 19th or early 20th century in origin and used for the transport of goods (e.g. a cargo ship, collier or trawler).
82. A review of reported wreck sites in the wider area identified one potential candidate for this ship, with a similar deck layout and dimensions - the *Hungate*, a steel screw steamer of 204 grt, registered in Grimsby in October 1900. An AEZ of 75m has been assigned around the wreck site (**Volume 5: Figure 24C-9**); for more on the identification of the wreck see Coracle Archaeology (2024b).
83. An additional live wreck is located within the revised Offshore Development Area. The SS *Saint Jacques* (**CA65**) was a French steel-hulled steamship of c. 2459 grt, built in Dunkirk in 1909. The vessel was stuck by a torpedo fired from the U-boat *UC-51* on 15 September 1917 while *en route* from Barry to North Africa with a cargo of coal. The engine room was wrecked and flooded, resulting in the loss of five crew. The remaining crew took to lifeboats and were rescued by the trawlers *Sidmouth* and *Barry* and the rescue tug HM *Frances Batey* (NPRN 273164). The wreck measures c. 88 x 11 x 9.5m and lies at a depth of c. 33m LAT, with debris visible on either side of the hull and keel (UKHO 58707).
84. Two areas of debris are located c. 35m to the south-east (NPRN 518627) and 30m to the south (NPRN 518626) of the wreck respectively. High-resolution bathymetry acquired in 2017 and hosted on the iMarDIS data portal shows a low-lying outline with a higher central section and outlying upstanding elements, possibly corresponding to the areas of debris noted above.
85. This wreck site is located in an area for which there is presently no project-specific geophysical survey data. An AEZ of 75m radius is nevertheless proposed, centred on the recorded location. This is considered sufficient to protect both the wreck and associated debris (NPRN518626-7). The size and exact location of this AEZ may be revised following the archaeological review of newly acquired project-specific survey data.
86. An additional findspot associated with the wreck is reported by the RCAHMW c. 675m to the south-west (NPRN 240744). This is described in the record as 'an oiler'; for the purposes of this report it is presumed to be a boiler. Neither high-resolution bathymetry data from the iMarDIS portal nor project-specific survey data are currently available for this location, though it is notable that there is no live record reported in this area by the UKHO. At present, this is assumed to be an isolated findspot. This will be reviewed following the archaeological assessment of new geophysical survey data.



87. One dead wreck (i.e., a wreck that has not been located in recent surveys) was recorded in the Offshore Development Area in the DBA (**CA7**; Coracle Archaeology 2024a). No corresponding anomalies were visible at or in proximity to this location during the archaeological review of marine geophysical survey data, and it will not be considered further here.
88. A number of the most significant cultural heritage assets located within the Offshore Development Area are to be found on the beach at Freshwater West. These are associated primarily with the submerged forest deposits identified by Leach and Wainwright and discussed in detail above (**CA8**; NPRN 524740; Dyfed HER primary record number (PRN) 11976; **CA9**; **Table 24C-3**). These include a near intact Mesolithic occupation site (**CA10**; PRN 503), incorporating a flint tranchet axe and flint flakes recovered from beneath the peat deposits, and a flint working site recorded by Leach during his investigations at Freshwater West, located to the south of the beach (**CA11**; PRN 10094). Following the April 2024 updates, the latter is now located outside of the Offshore Development Area but within the WSA.
89. Another exposure of intertidal peat (**CA12**; PRN 126540) is recorded as a monument in the Dyfed HER, c. 90 m to the south-west of the location of Leach's submerged forest as recorded by the RCAHMW. This includes two parallel bands of peat, a few metres wide. The seaward band reportedly contains tree stumps and branches; cloven hoof prints are recorded in the more landward exposure. The latter is also reported to contain human footprints, potentially of both adults and children. The peat appears to sit on a grey clay of possible marine or estuarine / riverine origin, overlying a reddish brown clay with frequent stone inclusions similar to the glacial till.
90. Only one of these sites is located in the areas surveyed in May 2023; **CA9** is an undulating peat surface identified in March 2020 in the Gravel Bay area and discussed above. The peat was not visible on the surface at the time of the survey. It is possible that the edge of the higher readings of conductivity and magnetic susceptibility visible in the geophysical survey data in this area relate to these deposits, though this cannot be confirmed from the geophysical data alone (see Coracle Archaeology 2024b).
91. Interestingly, Leach (1913) recorded small sharp flakes and chips from the sandy downwash on the side of Gravel Bay in the early 20th century; these were mapped by Wainwright (1963) alongside a series of lithic scatters located along the cliff line. Leach also reports flint flakes and implements, indistinguishable from those found at the 'chipping floor' sites, obtained near shell-heaps and shell-strewn spaces, although the location of these sites is unclear (Coracle Archaeology 2024a). No trace of these deposits were visible at the time of the survey, and no lithic artefacts were noted.
92. The lateral nature of peat and submerged forest deposits nevertheless suggests that there is the possibility that deposits associated with the submerged forest are located in proximity to both landfall options. Indeed, assessment of the electro-magnetic data from the landfall survey for both the northern and southern options indicated that the sand is not magnetically uniform at depth, which may reflect the presence of the submerged forest deposits at these locations (**Volume 5: Figure 24C-10**).
93. The Pembrokeshire coast and the approaches to Milford Haven appear to have been a considerable hazard to shipping throughout history, with numerous accounts of losses in the general area (e.g. **CA13-16**; Coracle Archaeology 2024 a; **Table 24C-3**). Little information is available for many of these wrecking incidents, and no remains have been identified positively by previous surveys. It is likely therefore that these relate to reports of losses, rather than the physical location of wrecks. No corresponding anomalies were visible at or in proximity to



- CA13-CA16** during the archaeological review of marine geophysical and landfall survey data, and these wrecks will not be considered further in this report.
94. A further wreck (**CA64**; NPRN 272405) is identified in the Offshore Development Area: the *Hope*, a wooden schooner built at Bideford in 1849. The vessel was involved in a collision on 22 October 1901 ‘five mile south-east of St Ann’s Head’ and subsequently foundered. This record was previously located in the WSA; following the issue of the April 2024 update it is now located within the Offshore Development Area. No project-specific geophysical survey data is available for the recorded location of this wreck, and it is presumed to be a loss report, rather than the physical location of a wreck. This will be reassessed following the archaeological review of newly acquired geophysical datasets.
 95. A maritime named location is also recorded within the southern survey area at Freshwater West (**CA17**). These locations serve to highlight the archaeological potential of an area, based on the number of reported maritime losses recorded in the vicinity. At Freshwater West, this includes 15 reported wrecks (**CA18-32**; Coracle Archaeology 2024a; **Table 24C-1**; **Table 24C-3**). These losses have been assigned a temporary spatial coordinate by the RCAHMW; this represents the centre of the generalised area in which the loss was recorded, pending additional information becoming available. The location should not therefore be seen as indicative of the presence or absence of physical remains. No anomalies were visible in the assessment of the landfall or marine geophysical survey datasets, and no features were visible on the surface during the landfall walkover surveys. These wrecks will not be considered further here.
 96. Two aircraft losses are recorded within the Offshore Development Area (**CA33-4**), including one (**CA33**) recorded at the maritime named location (**CA17**) described above. A Vickers Wellington Xii *Mp638* (**CA33**) is reported to have belly-landed on the beach on 9 April 1944. It is believed that the aircraft was recovered intact and no remains have been reported at this location (NPRN 515652). An alternative location for this aircraft is recorded in the Dyfed HER, c. 350 m to the south (PRN 105259). This location is classified as both a Protected Place and a Site of Special Scientific Interest (SSSI) in the Dyfed dataset, though it is possible that this may relate more broadly to the beach and dune sequence itself. No remains of this aircraft were identified during landfall surveys in May 2023.
 97. An Armstrong Whitworth Whitley V *Z6941* aircraft (**CA34**; NPRN 515914) was also reported in the DBA, within the proposed Array Area. The aircraft reportedly ditched into the sea c. 35 km southwest of Milford Haven on 2 October 1941. The seabed in this area shows a series of bedforms and the occasional boulder, with no anomalies in the area that might suggest the presence of ferrous material just below the seabed surface (Coracle Archaeology 2024b).
 98. It is important nevertheless to note that the ephemeral nature of crash sites at sea, combined with difficulties inherent in accurately recording crash site locations, means that remains may not always be present at the stated locations. These locations should be seen as providing an indication that aviation remains may exist at, or in proximity to, the general area. As yet, no remains of these aircraft have been confirmed at their given locations, nor were any aviation remains identified during the review of available marine geophysical survey datasets. If remains are encountered during works associated the proposed Project, they would be designated automatically as Controlled Sites under the Protection of Military Remains Act 1986.
 99. There are two obstructions recorded in the Offshore Development Area, one classified as live (**CA36**) and the other as dead (**CA37**). No corresponding signatures were visible in the geophysical survey data, and they will not be considered further in this report.



100. Two further sites are recorded in the Offshore Development Area (**CA38-39**), in addition to those associated with the submerged forest deposits (**CA10**). These include the location of a Bronze Age hoard (**CA38**), and a landing place (**CA39**), both located on the beach at Freshwater West.
101. The Bronze Age hoard recovered from the beach at Freshwater West included 23 bronze ingots, fragments of three socketed axes, a fragment of an Ewart Park-type sword and the broken tip of a Carp's tongue-type sword (**CA38**; PRN 14393). The latter was the first of its type to be found in Wales. This location is also defined as a SSSI in the Dyfed HER, though again it is unclear whether this refers to the beach and dune sequence more generally. The hoard appears to be an isolated findspot; it is included here to highlight the potential for similar finds to be made during works associated with the proposed Project.
102. A convergence of tracks from the quarries to the south and a gravel pit to the north suggests the presence of a landing place (**CA39**) on the beach at Freshwater West, close to Gupton Barrows Bridge. The Ordnance Survey first edition 25-inch map of Pembrokeshire also shows the track from the ford to the north-east of the bridge (NPRN 524958; PRN 129354). The site is located c. 500m to the south-east of the southern landfall option; the proposed Project is unlikely to impact this site so it will not be considered further here.
103. Four further findspots are recorded within the Offshore Development Area in the RCAHMW, Dyfed HER and National Museum of Wales (NMW) datasets, including a prehistoric flint flake (**CA41**), the metapodial bone of a red deer (**CA42**), a Bronze Age arrowhead with a chert pebble (**CA43**) and a number of bones (**CA60**). The origin and date of the bones is not recorded, and they were subsequently reburied. The coordinates provided for this record place the findspot c. 850m to the south-west of the dune sequence, within the intertidal zone, which would suggest that it is spatially inaccurate. This record was previously located within the WSA; the latest iteration of the proposed Project boundaries places it within the Offshore Development Area. All of these findspots are considered to represent casual, isolated finds. They are nevertheless included here to highlight the long history of the region and the potential for encountering similar finds during works associated with the proposed Project.
104. A geophysical anomaly identified during the archaeological assessment of data collected for the Project Erebus offshore windfarm is included within the latest update of the RCAHMW dataset (**CA66**; Erebus anomaly number ERS21_0106). The anomaly is described as being of medium archaeological potential, and comprises parallel linear features covering an area of c. 47.9 x 5.9m (NPRN 800237). The anomaly is located on two magnetometer lines but has no corresponding signature in the Erebus magnetic data. No corresponding anomalies were visible at this location during the archaeological review of project-specific geophysical survey data, and it is likely that it is geological in origin. This anomaly is considered to be of low archaeological potential, and it will not be considered further here. A number of other geophysical anomalies identified by Project Erebus and included in the latest RCAHMW dataset are located in the Offshore Development Area. These were all classified as being of uncertain archaeological potential. Review of these locations suggests that they are geological in origin and they will not be considered further in this report.
105. Two geophysical anomalies identified in the archaeological review of project-specific marine geophysical survey data are considered to be of medium archaeological potential. Typically, these have multiple lines of evidence to suggest the presence of surface or near-surface features, but are not clearly identifiable as archaeological in origin (Coracle Archaeology 2024b). These include:
 - **CA1026**, a cluster of SSS anomalies within an area of scour between bedforms; and



- **CA1029**, two magnetic anomalies measuring 255 and 21nT.
106. These have been assigned AEZs of 30m and 40m respectively (**Table 24C-2**). A gazetteer of all anomalies with archaeological potential located within the latest iteration of the Offshore Development Area is included in **Annex 24C-B**.
107. Landfall geophysical survey data showed similar patterns of conductivity and magnetic susceptibility in both the northern and southern survey areas (**Volume 5: Figure 24C-10**). Lower conductivity readings were recorded towards MHWS at the eastern extent of both survey areas, indicative of the drier sand components of the beach and shingle deposits. Conductivity readings generally increased in intensity westwards towards mean low water, with waterlogged beach deposits visible in the higher conductivity readings of the northern survey area. It is possible that the edge of the higher readings of conductivity and magnetic susceptibility visible in this area relate to the submerged forest deposits previously recorded at Gravel Bay (**CA9**), though this cannot be confirmed from the geophysical data alone. In the southern survey area, the sand is not magnetically uniform at depth, with lobe-shaped quadrature variations. This too may be indicative of the presence of submerged forest deposits beneath the mobile beach sands (Coracle Archaeology 2024b).
108. A linear anomaly is visible, however, in the geophysical and metal-detecting datasets in the northern survey area, running approximately south-west / north-east (**Volume 5: Figure 24C-10**). This anomaly was also recorded in the geophysical surveys undertaken in support of the Greenlink Interconnector cable (Cotswold Archaeology 2019), where it was identified as a relict MoD listening cable. It is not considered to be archaeological, and will not be considered further in this report.
109. A linear feature may also be visible in the metal detections in the southern survey area, c. 35 m from the proposed survey centreline. The potential feature runs for c. 130 m in a south-west / north-easterly direction (**Volume 5: Figure 24C-10**); the metal detections are, however, too sparse (c. 20 m apart) to discount the possibility that the alignment is simply coincidental.
110. Relatively low numbers of metal detections were recorded in both survey areas on the beach; this may be due in part to the presence of teams of volunteer beachcombers, committed to keeping the beach clean. In addition, the wide, exposed nature of the beach means that metallic objects are perhaps more likely to be swept offshore and redeposited. Readings do, however, become denser in both survey areas towards the mean high water mark. These areas are associated with the start of the low pebble and shingle bank, and may be indicative of casual losses, driven ashore by the tide (**Volume 5: Figure 24C-10**).
111. Two substantial metallic objects were also recorded in the walkover and metal-detector surveys, both found amongst the rocks at Gravel Bay in the northern survey area. One appears to be the disarmed remains or a dummy of a WWII mine or bomb, the other a boat mooring, which is a common beach find (see Coracle Archaeology 2024b). Neither are considered to be in-situ, and neither are considered to be of archaeological significance. They will not be considered further here.
112. The northern extent of the Offshore Development Area is located within the Milford Haven Waterway Historic Landscape Area, principally the West Angle to Freshwater West coastal strip. This is limited to a small area to the north of Freshwater West, measuring c. 0.5 hectares (**Volume 5: Figure 24C-11**).
113. The West Angle to Freshwater West coastal strip consists of a c. 7 km strip of high, hard-rock sea cliff. The historic landscape of the coastal strip is characterised by varied archaeological sites, including military installations dating from the 16th to the 20th century, and the Grade II listed 19th century fort on Thorn Island, now converted to a hotel. In addition, an Iron Age



hillfort is located on the cliffs to the south of West Angle Bay; none of these sites or monuments are located within the Offshore Development Area and they will not be considered further here.

114. A number of event records are recorded in the Offshore Development Area in the Dyfed HER. Essentially, these are records of previous archaeological surveys and excavations conducted in proximity to the proposed Project; full details can be found in the project-specific DBA (Coracle Archaeology 2024a).

Submerged Palaeo-Landscapes

115. The following discussion of submerged palaeo-landscapes is based on the geophysical survey data collected for a previous iteration of the OfECC. It will require revision following archaeological assessment of newly acquired survey data, post-submission. Palaeo-landscape features are, however, laterally extensive and are unlikely to be restricted to the OfECC itself. What follows therefore provides an indication of the potential for encountering deposits of geoarchaeological or palaeo-environmental interest during works associated with the proposed Project.
116. Seismic (SBP) survey data were acquired within the frequency band of 2-16 kHz. This type of higher frequency system is suitable for producing high-resolution images that can resolve small features, and identify acoustic impedance in sub-surface deposits. It is, however, limited by shallow seabed penetration, typically only 10s of metres in optimal conditions. Consequently, for much of the survey area, the full thickness of the Quaternary sedimentary sequence, down to underlying bedrock, is not visible in the collected dataset. Nevertheless, given that the most spatially extensive activities (e.g. the installation of export cables, inter-array cables, mooring points and lines) will only affect the seabed and upper few metres of the Quaternary sequence, the available SBP data is regarded as sufficiently robust to assess these impacts. In contrast, activities which penetrate the seabed to significant depth are much more limited in scale, and restricted to piling within the Array Area.
117. Bedrock is present at or close to the seabed surface at the approaches to Freshwater West, indicated by a strong impedance reflector with occasional sub-surface dipping reflectors, indicative of some faulting. Approaching the beach at Freshwater West, a wedge of coarser grained sediments thickens landward; this is likely to be representative of sand. The base of this sediment facies shows a strong impedance reflector signifying the underlying geology, with no apparent basal features (such as organic deposits) sitting above the bedrock channel base (Coracle Archaeology 2024b).
118. South of the entrance to the port of Milford Haven, bedrock remains close to the seabed surface, with only a thin capping of sediment. This overlying sediment thickens to the south where it encounters a large sandbank, where sand sits over the bedrock (Coracle Archaeology 2024b). This pattern of thin, surface sediments overlying the bedrock, thickening where sandwaves and sandbanks are present, continues south until the central part of the Offshore Development Area, where a series of sub-surface late Pleistocene channels have been observed in the data.
119. These channels cross the Offshore Development Area corridor at an oblique angle; it is possible that they represent different phases of activity, with the deeper channel appearing to be truncated by the shallower. The fill of the deeper channel is unclear, though it appears to have a somewhat grainy acoustic fill with some high amplitude reflectors, perhaps representing coarse-grained sediments. By contrast, the shallower channel appears to have a smoother acoustic fill with some low amplitude reflectors, which may imply the presence of



- finer-grained sediments. Away from the channels, bedrock appears close to the surface where both sandwave and sandbanks become thinner (Coracle Archaeology 2024b).
120. Further south, these channels disappear and are replaced by a veneer of parallel stacked facies, though the base of the lower fill, its relationship to the underlying geology, and the internal structure of the upper Pleistocene facies, remains unclear (Coracle Archaeology 2024b). As the Offshore Development Area crosses another large pair of sandwaves, the sub-surface structure of these Pleistocene deposits becomes more complex, featuring a series of stacked high amplitude reflectors, sitting on a series of lower amplitude dipping and onlapping reflectors, likely associated with another channel fill (Coracle Archaeology 2024b). These features appear to be extensive laterally in the southern parts of the Offshore Development Area as it approaches the Array Area.
 121. The sub-surface stratigraphy of the Array Area is not particularly clear. In some areas, an acoustically transparent sub-surface unit appears to predominate, with the hyperbolae visible in some survey lines at 10-20m below the seabed surface likely indicative of boulders within Pleistocene sediments (Coracle Archaeology 2024b). Near-surface channels remain a prominent feature in the western and south-west corner of the Array Area, showing late Pleistocene incision into the underlying older Pleistocene deposits. These channels are orientated predominantly in a southern direction (Coracle Archaeology 2024b).
 122. Assessment of the supplied SBP data has demonstrated the presence of a number of channels and thick fills in the southern half of the Offshore Development Area and across the Array Area. The relationship between these different features suggests multi-phased, late Pleistocene deposition. Deposits are likely to consist of a till facies of clay, sand, gravel, cobbles and boulders, with hyperbolae visible in the centre of the Array Area implying the presence of boulders at depth.
 123. Channel features appear to be extensive throughout the Offshore Development Area, though these lack any associated adjacent floodplain areas. Instead, a multi-phased incision is traceable laterally between adjacent survey lines. These are likely all late Pleistocene deposits, formed as a result of pro-glacial processes and subsequent catchment drainage (Coracle Archaeology 2024b). The geoarchaeological potential of these deposits is likely to be low, as no deposits or features attributable to temperate environments, or those within which occupation might have occurred, have been observed. The use of optically-stimulated luminescence (OSL) dating techniques to date deposits recovered from these areas during geotechnical site investigations would, however, have the potential to enhance our understanding of late glacial dynamics in the eastern Celtic Sea, a topic of considerable interest.
 124. In the northern half of the Offshore Development Area, bedrock is present closer to the seabed surface, with overlying sediments typically associated with areas containing sandbanks or sandwaves. No visible palaeo-landscape features are present beneath these features, with coarse-grained sands, gravels and modern marine bedform deposits sitting directly on the bedrock surface. The offshore extent of the submerged forest at Freshwater West is therefore unclear, though the project-specific SBP data suggest that it does not extend as far as the inshore limit of the SBP survey, c. 1.7km off Freshwater West.

24.6 Conclusions

125. Detailed investigations have sought to assess the marine archaeology, and characterize the archaeological potential of, the area in proximity to the proposed Project, encompassed by the Offshore Development Area. This will ensure that potential impacts of the proposed Project upon the cultural heritage resource are avoided, minimised or mitigated.



126. Assessment of the available SBP data has shown thick Quaternary deposits, largely consisting of late Pleistocene (Devensian) glacial deposits distributed across both the Array Area and the OfECC as it moves towards the shore. Many of these features are likely to consist of till clays, sands and gravels, with boulders also visible in the array areas.
127. A number of channel features are also visible in the Offshore Development Area, though these lack any associated floodplain features. These are likely to be late Pleistocene in origin, formed through pro-glacial processes and subsequent catchment drainage. The geoarchaeological and palaeo-environmental potential of the Offshore Development Area is therefore considered low. The use of OSL dating techniques to date deposits recovered from these channel features during geotechnical site investigations would, however, provide valuable geochronological information that would serve to inform the late Pleistocene record of this area. Geotechnical surveys will be undertaken post-consent.
128. As the OfECC approaches the shore at Freshwater West, mobile sediments appear to sit directly above the underlying bedrock. The offshore extent and depth of submerged forest present at Freshwater West is therefore unclear.
129. The DBA identified 41 cultural heritage assets within the Offshore Development Area, including 25 wrecks, two aircraft, two obstructions, one maritime named location, four findspots, three sites, one monument, two features and one anomaly. None of the wrecks are designated or protected, and the monument is not scheduled.
130. The archaeological assessment of marine geophysical survey data identified four anomalies with archaeological potential within the revised iteration of the Offshore Development Area. Of these, one is considered to be of high, and two of medium, archaeological potential. The anomaly of high archaeological potential corresponds to a known wreck site identified in the DBA; AEZs, ranging in radius from 30 to 75m have been assigned to each anomaly considered of high or medium archaeological potential. A further AEZ has been assigned to a live wreck recorded in the UKHO and RCAHMW datasets and visible in the high-resolution bathymetry hosted by iMarDIS. The size and exact location of this AEZ will be reviewed following the collection and archaeological assessment of geophysical survey data for this section of the revised OfECC.
131. Walkover, metal-detecting and geophysical surveys conducted at both the southern and northern landfall options at Freshwater West did not identify any anomalies or features with archaeological potential. One linear anomaly was visible in the geophysical and metal-detecting survey data at the northern landfall option; this has been identified as a relict MoD listening cable. The northern landfall is now the preferred option.
132. No exposures of peat were visible on the surface of the beach at the time of the landfall surveys, though the number of well-documented peat deposits at Freshwater West, combined with the laterally extensive nature of submerged forests, suggests that they may be encountered during works associated with the proposed Project. Assessment of the landfall geophysical survey data indicated that the sand is not magnetically uniform at depth, which may indicate the presence of the submerged forest at these locations. This would be confirmed by a programme of geoarchaeological sampling (coring) on the beach, should site investigations be required in advance of installation.
133. It is interesting to note that the recorded location of the wreck of the *Willemoes of Thuro* was not visible at the time of survey, nor does it appear to have been detected in the geophysical survey data collected from the beach. This is likely to be the result of elevated levels of beach sand in May 2023. An AEZ of 50 m has nevertheless been assigned to mitigate any potential impacts during proposed works.



134. The proposed Project will be installed in an area of considerable maritime activity in the past, at local, national and international levels. Despite the relative scarcity of known and identified wreck sites within the Offshore Development Area, and the tentative nature of many of the loss reports described in the DBA, it is not possible to discount the potential for encountering unknown maritime cultural remains during works associated with the proposed Project. The possibility of doing so is therefore considered moderate. Any previously unknown discoveries will be mitigated through the implementation of a project-specific protocol for archaeological discoveries.



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Annex 24C-A Gazetteer of Cultural heritage assets previously within the Offshore Development Area

Table 24C-4. Cultural heritage assets located within previous iteration of the Offshore Development Area

CA no.	Name	Type	Date	Status	Easting (UTM 30N)	Northing (UTM 30N)	Source
3	Lcg No 15	Wreck	1943	Live	353576	5725233	UKHO; RCAHMMW
4	Antonio	Wreck	1945	Live	349350	5720601	UKHO; RCAHMMW
5	Unknown	Wreck	Unknown	Live	351224	5724726	UKHO; RCAHMMW
11	Flint working site	Site	Mesolithic	n/a	357571	5724608	Dyfed HER
35	Sheep Rock	Seascape	Multiperiod	n/a	352430	5726221	RCAHMMW
40	Spoil Ground, off The Row's Rocks, Milford Haven	Site	Modern	n/a	350477	5725797	RCAHMMW
44	Leaden tablet	Findspot	Early medieval	n/a	356079	5724087	Dyfed HER
45	Anchorage, Freshwater Bay	Monument	1884	n/a	354513	5725220	RCAHMMW

Table 24C-5. Llŷr 1 WSA gazetteer entries

CA no.	Name	Type	Date	Status	Easting (UTM 30N)	Northing (UTM 30N)	Source
CA11	Flint working site	Site	Mesolithic	n/a	357571	5724608	Dyfed HER
CA46	<i>Christian Borum</i>	Wreck	2003	Live	340378	5687754	UKHO
CA47	<i>Renfrew</i> (possibly)	Wreck	Unknown	Live	338253	5709869	RCAHMMW
CA56	Foul Ground	Obstruction	Unknown	Live	340144	5711704	UKHO
CA67	<i>Wave</i>	Wreck	1859	Reported loss	357969	5723146	RCAHMMW
CA68	Submerged Forest	Feature	Prehistoric	Extant	358023	5722994	RCAHMMW
CA69	Submerged Forest	Feature	Prehistoric	Extant	357973	5722717	RCAHMMW
CA70	Submerged Forest	Feature	Prehistoric	Extant	358076	5722910	RCAHMMW; Dyfed HER
CA71	Bluck's Pool	Feature	Unknown	Unknown	357287	5722499	RCAHMMW
CA72	Findspots of flints	Findspot	Prehistoric	Unknown	358089	5723116	Dyfed HER



CA no.	Name	Type	Date	Status	Easting (UTM 30N)	Northing (UTM 30N)	Source
CA73	Brownslade Burrows	Landscape	Unknown	Unknown	358091	5723115	RCAHMMW
CA74	ERS21_0103	Anomaly	Unknown	Live	341391	5713917	RCAHMMW

Annex 24C-B Marine Geophysical Anomalies with Archaeological Potential

Table 24C-6. Marine geophysical anomalies with archaeological potential located in the revised Offshore Development Area

CA no.	Easting UTM 30N	Northing UTM 30N	Description	Archaeological potential	Proposed AEZ radius
1025	334581.4013	5701369.799	Clearly visible wreck, aligned N-S, associated with SSS anomalies S-ECR_S-0224-BSP, S-ECR_S-0225-BSP, S-ECR_S-0227-BSP and S-ECR_S-0429-BSP, with bow pointing south. Wreck appears largely intact, measuring 38x9x3.5m, with hull and superstructure appearing to be intact. Scour is present at the stern and bow, with some W-E scour also evident. Associated with magnetic anomaly M-1049-ECR_S-BSP (279nT)	High	75
1026	333160.9521	5696796.436	SSS anomalies S-OWF-0002-BSP, S-OWF-0003-BSP, S-OWF-0004-BSP and S-OWF-0005-BSP, a group of anomalies up to 1.5m, within an area of scour between bedforms, measuring 15x14x0.3m	Medium	30
1028	329666.9013	5692266.599	Magnetic anomaly M-0233-OWF_C-BSP (126nT), in close proximity to a series of small probable boulders	Low	n/a
1029	340382.0007	5685354.399	Magnetic anomalies M-0019-OWF_G-BSP (255nT) and M-0258-OWF_G-BSP (21nT)	Medium	40

